Industrial Waste Diversion Program

Final Reports #14

FINAL REPORT ON THE INSTALLATION AND OPERATION OF ATMOSPHERIC EVAPORATORS AT ACADIAN BARREL FINISHING

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Report prepared for :

Waste Management Branch
Ontario Ministry of the Environment

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Report prepared for:

Waste Management Branch
Ontario Ministry of the Environment

In consultation with

Acadian Barrel Finishing

Report prepared by:

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DISCLAIMER

This report is in partial fulfillment of conditions of a grant given to Acadian Barrel Finishing by the Ministry of the Environment under the Industrial Waste Diversion Program. The report was prepared by J. Sutherland for Acadian Barrel Finishing and documents results of work for which the Ministry of the Environment provided financial assistance.

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INTRODUCTION.

Two atmospheric evaporators were installed on the " Harshaw Plating Line " at Acadian Barrel Finishing in January 1989.

The " Harshaw Plating Line " is a barrel plating line that uses a chloride zinc plating solution to bulk finish steel articles with a thin film of zinc metal. The zinc coating enhances the appearance and durability of the coated parts. Due to the nature of barrel plating operations a substantial amount of the zinc plating solution is removed with each batch of plated parts. This material is then rinsed off the parts and is subsequently treated in the waste treatment facility prior to discharge to the municipal sewer.

The purpose of installing the atmospheric evaporators was to reduce the amount of zinc plating solution that was lost through drag out and to recover as much as possible of this solution.

The evaporators were commissioned in February 1989 and their performance monitored during the rest of 1989.

CONCLUSIONS.

The installation of the atmospheric evaporators at Acadian Barrel has resulted in a substantial reduction in the amount of waste materials being emitted into the environment and will continue to do so in the future.

The evaporators recovered approximately sixty percent of the salts that were dragged out of the zinc plating tank. This resulted in the following reductions in generation of waste materials.

The amount of zinc hydroxide that would have been generated if the evaporators had not been in use was 8,279 pounds. This material would have been disposed of in landfill if the evaporators had not been in use.

The amount of chloride salts that would have been discharged to the municipal sewer was 59,908 pounds. As this material is not removed by the waste treatment system at Acadian Barrel or by the municipal treatment plant it would eventually have been discharged into the lake.

Hence the installation and operation of the atmospheric evaporators eliminated the emission of 68,187 pounds of waste material into the environment in 1989.

The cost savings produced by these evaporators in 1989 was $ 19,223.46

The payback on the installation of the atmospheric evaporators is expected to be in the order of 34 months.

Reduction in chloride salt usage.

In 1988 chloride salt additions of 105,248 pounds were made to the plating tank.

In 1989 chloride salt additions of 36,920 pounds were made to the plating tank.

Hence the amount of chloride salts that would of been lost if the evaporators had not been in use in 1989 was equivalent to the chloride salt additions 1988 (adjusted for the reduced workload in 1989) minus the actual usage in 1989.

(105,248 * .92) - 36,920 = 59,908 pounds

Hence the amount of chloride salts recovered by the evaporators was 59,908 pounds in 1989.

Reduction in zinc usage.

Zinc is lost from the zinc plating solution by drag out and by being electroplated onto parts. In order to calculate the amount lost from drag out alone it is necessary to deduce it in the following way.

The amount of zinc that would be lost through drag out is proportional to the amount of chloride that is lost through drag out. The chloride salts are only lost through drag and are not consumed in the process. The chloride salts lost through drag out are replaced by chemical additions and can be calculated by totaling the amount of chloride that is added to the bath to maintain the chloride concentration.

Typical analysis of the plating bath

zinc	3 oz/gall
potassium chloride	28 oz/gall
ammonium chloride	5 oz/gall

Hence for every 33 oz of chloride salts that are dragged out 3 oz of zinc is dragged out.

In 1988 chloride salt additions of 105,248 pounds were made to the plating tank. This means that an equivalent amount of salts was lost through drag out. Thus the amount of

zinc that would have been lost at the same time was.

3 / 33 * 105,248 = 9,568 pounds

In 1989 chloride salt additions of 36,920 pounds were made to the plating tank. This means that an equivalent amount of salts was lost through drag out. Thus amount of zinc that would have been lost at the same time was.

3 / 33 * 36,920 = 3,356 pounds

Hence the amount of zinc that would have been lost if the evaporators had not been in use in 1989 was equivalent to the zinc usage in 1988 (adjusted for the reduced workload in 1989) minus the actual usage in 1989.

(9,568 * .92) - 3,356 = 5,447 pounds

This material would have been removed in the waste treatment system as zinc hydroxide. The amount of zinc hydroxide that 5,447 pounds of zinc would form is:

5,447 * 1.52 = 8,279 pounds.

Hence the amount of zinc recovered by the atmospheric evaporators was 5,447 pounds in 1989.

Reduction in usage of other materials.

Reductions in usage of other components of the plating bath are considered to be insignificant.

Effects on the waste treatment system have also been disregarded due to the large number of other variables that effect operating costs of the waste treatment facility.

Reductions in operating costs in 1989.

Potassium chloride

There was a reduction in usage of potassium chloride of 40,300 pounds. Adjusting for the reduced workload in 1989 this would be equivalent to:

40,300 * 0.92 = 37,076 pounds.

The current price for this materials is $ 0.13 per pound. Hence the cost savings was:

37,076 * 0.13 = $ 4,819.88

Ammonium chloride

There was a reduction in usage of ammonium chloride of 17,472 pounds. Adjusting for the reduced workload in 1989 this would be equivalent to:

17,472 * 0.92 = 16,074 pounds.

The current price for this materials is $ 0.31 per pound. Hence the cost savings was:

16,074 * 0.31 = $ 4,982.94

Zinc chloride

There was a reduction in usage of zinc chloride of 10,556 pounds. Adjusting for the reduced workload in 1989 this would be equivalent to:

10,556 * 0.92 = 9,712 pounds.

The current price for this materials is $ 0.97 per pound. Hence the cost savings was:

9,712 * 0.97 = $ 9,420.64

Total savings on chloride salts

The total savings on the above materials was $ 19,223.46.

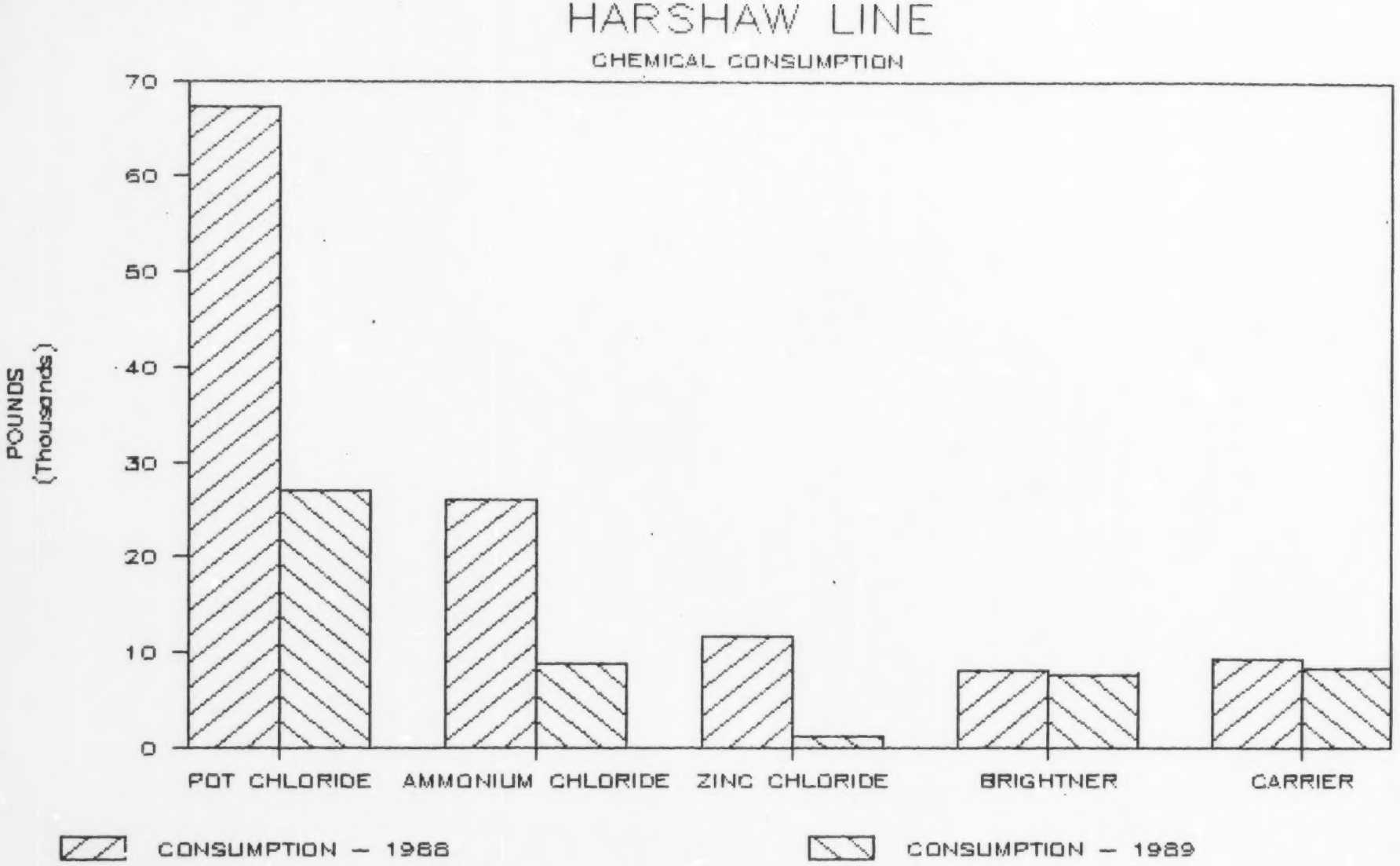
Payback.

Based on annual savings of $ 19,223.46 and a capital cost 54,343.00 for the project we expect the following payback period.

Capital cost / Savings * 12 = Payback period in months

54,343.00 / 19,223.46 * 12 = 34 months

The payback for the installation of the atmospheric evaporators is expected to be in the order of 34 months.


HARSHAW LINE
CHEMICAL CONSUMPTION
POUNDS
(Thousands)
70
60
50
40
30
20
10
0
POT CHLORIDE
AMMONIUM CHLORIDE
ZINC CHLORIDE
BRIGHTNER
CARRIER
CONSUMPTION — 1988
CONSUMPTION — 1989

Harshaw Plating Line.

Chemical consumption 1988 to 1989.

Material	Usage		Reduction in usage	
	Pounds per year		Pounds	Percentage
	1988	1989		
Potassium chloride	67,288	26,988	40,300	60
Ammonium chloride	26,208	8,736	17,472	67
Zinc chloride	11,752	1,196	10,556	90
Brightner	8,008	7,493	515	6
Carrier	9,380	8,294	1,086	12

Total chloride salts used in 1988 was 105,240 pounds.

Total chloride salts used in 1989 was 36,920 pounds.

Reduction in chloride salt consumption was 68,320 pounds.